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GB 2358382 A
GB 1292799 A
CA 002314363 A
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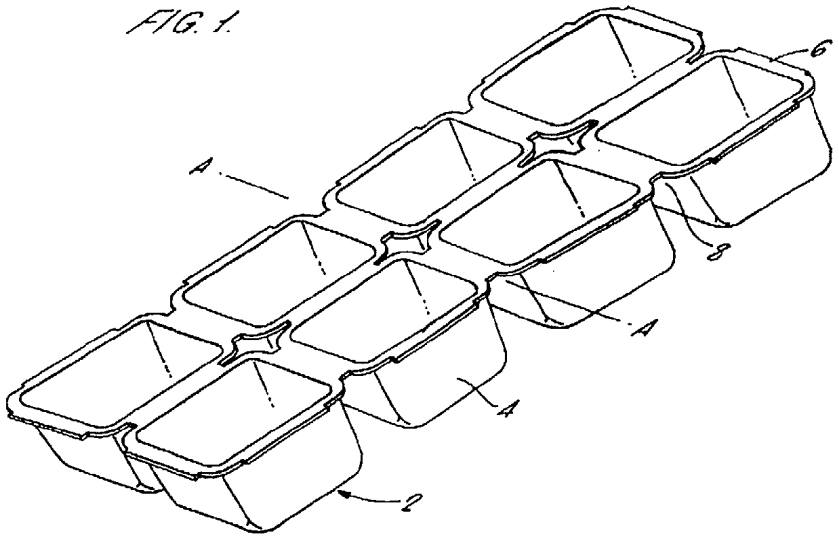
(54) Abstract Title
Water soluble container

(57) A rigid, water soluble container is formed at least partially from an injection moulded polymer which, when dissolved in water, is active in detergency, wherein the polymer is not polyvinyl alcohol. A rigid, water soluble container formed at least partially from an injection moulded polymer which, when dissolved in water, acts as a water softener or a dye transfer inhibitor, is also disclosed. The polymer may be polyvinyl pyrrolidone, polyacrylic acid or an ester thereof, polymaleic acid or an ester thereof, or a copolymer of any thereof. The container may comprise a receptacle part sealed by a water soluble polyvinyl alcohol film. The container typically encases a fabric care, surface care, or dishwashing composition. A method of manufacturing the container or an array of such containers 2 is also claimed.

FIG. 1.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

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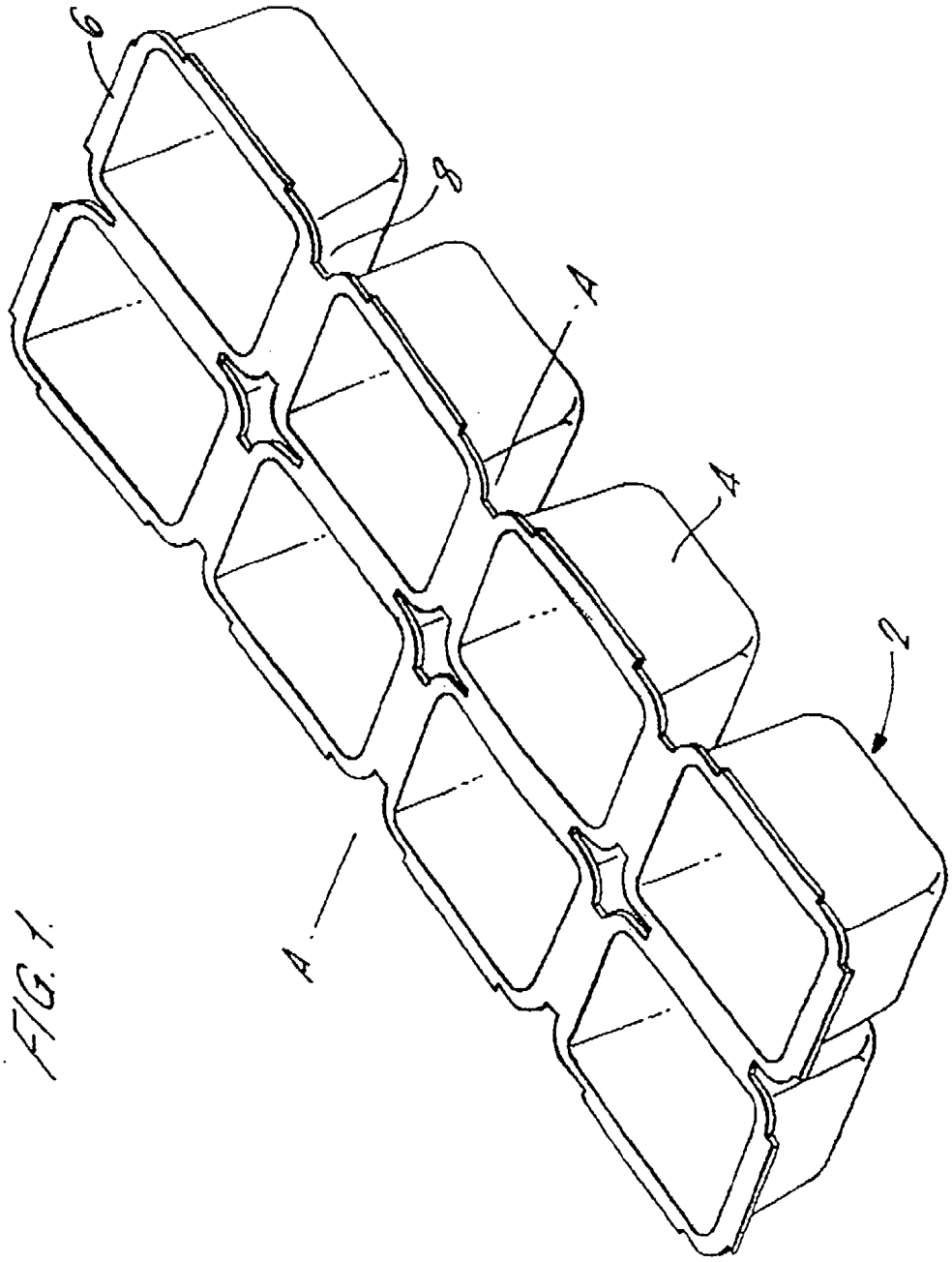


FIG. 1.

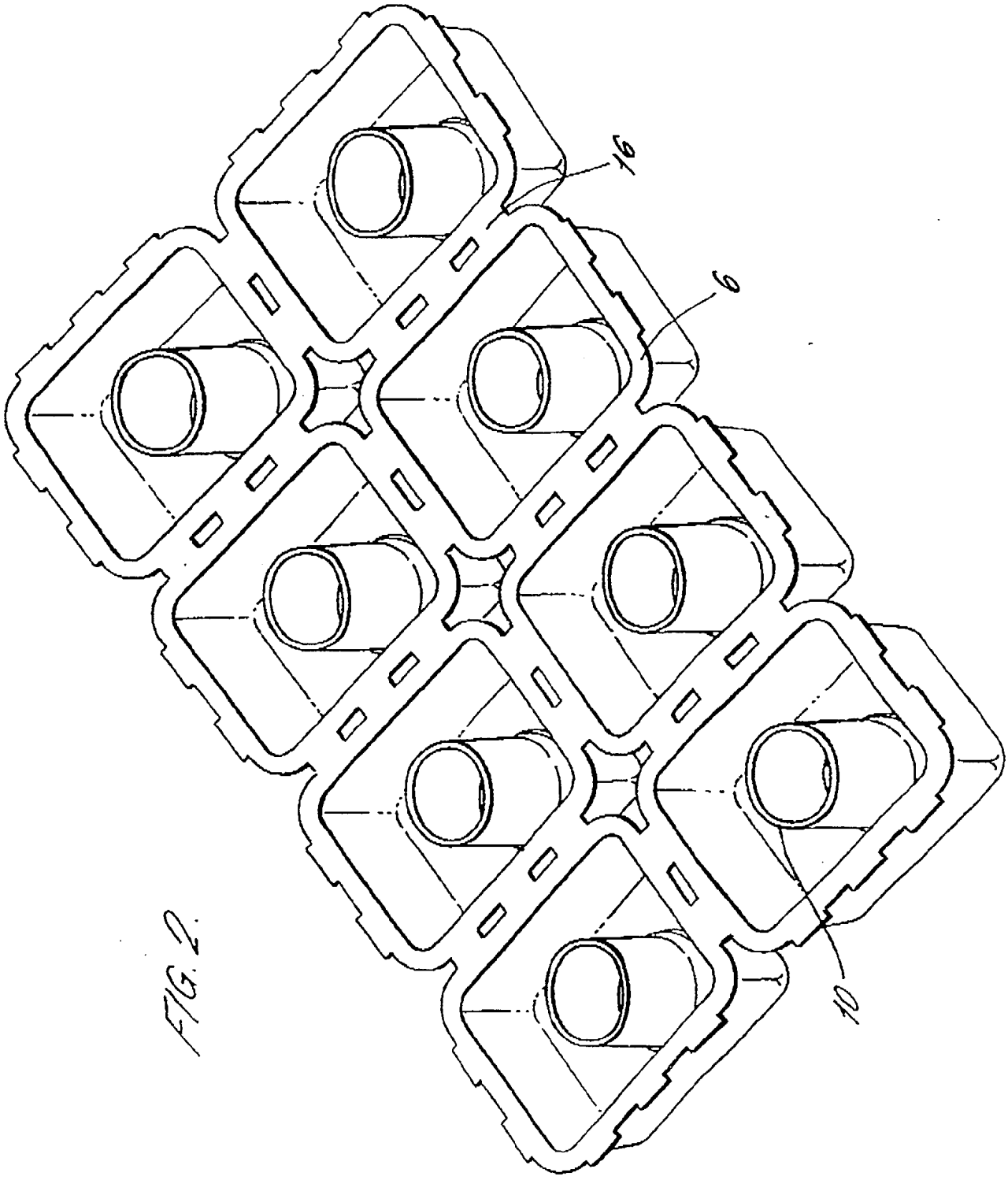


FIG. 2.

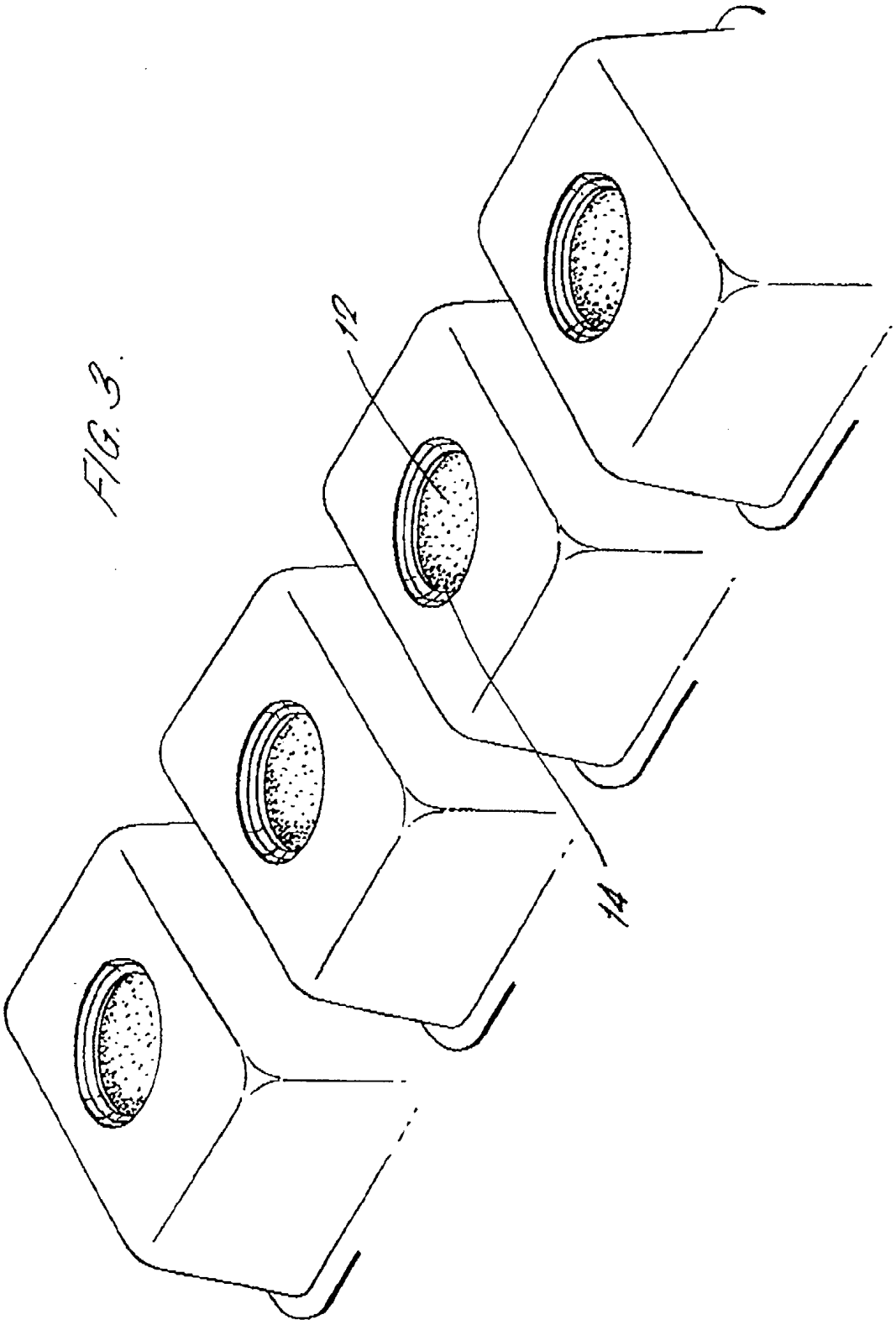
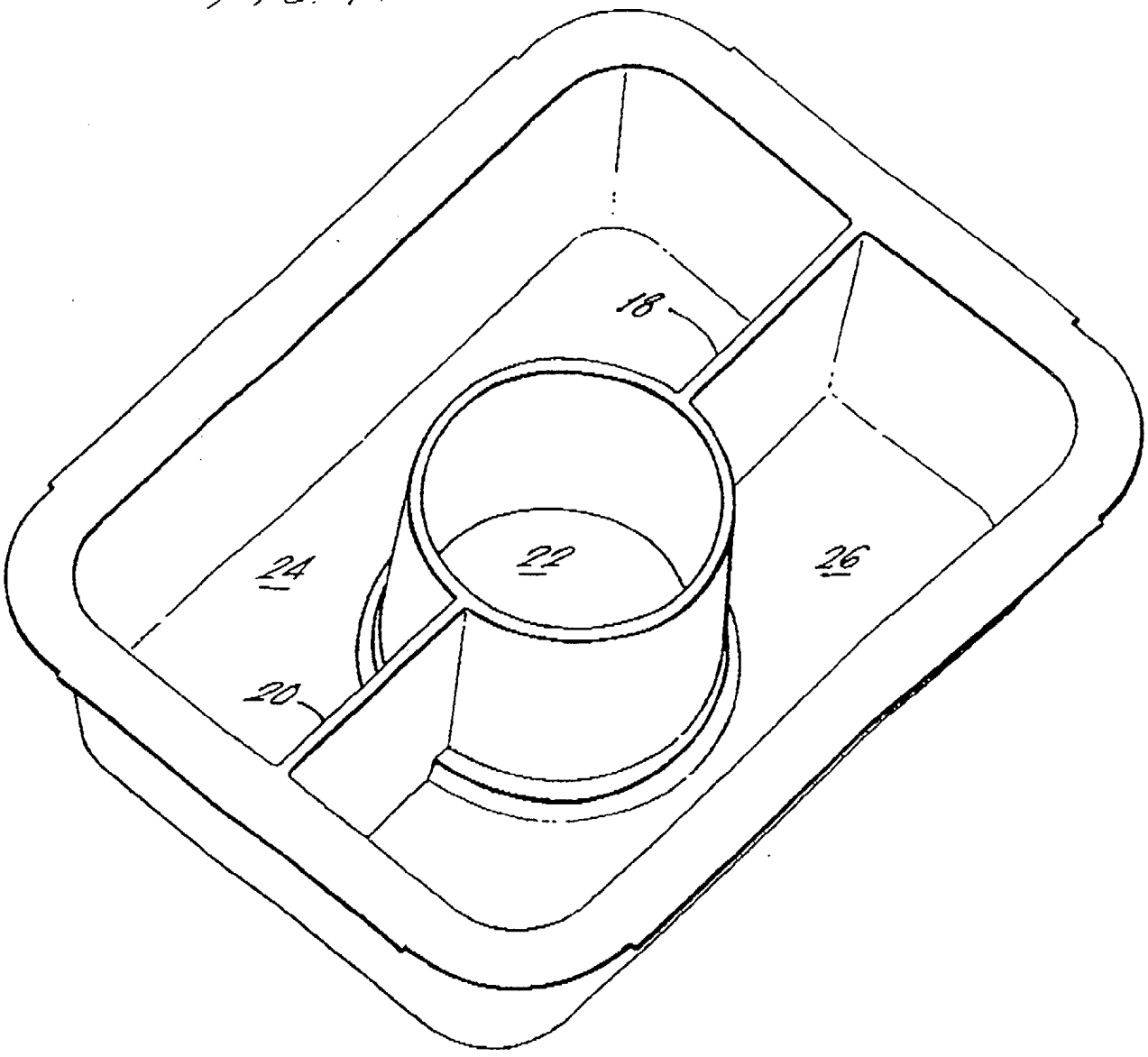


FIG. 3.

FIG. 4.



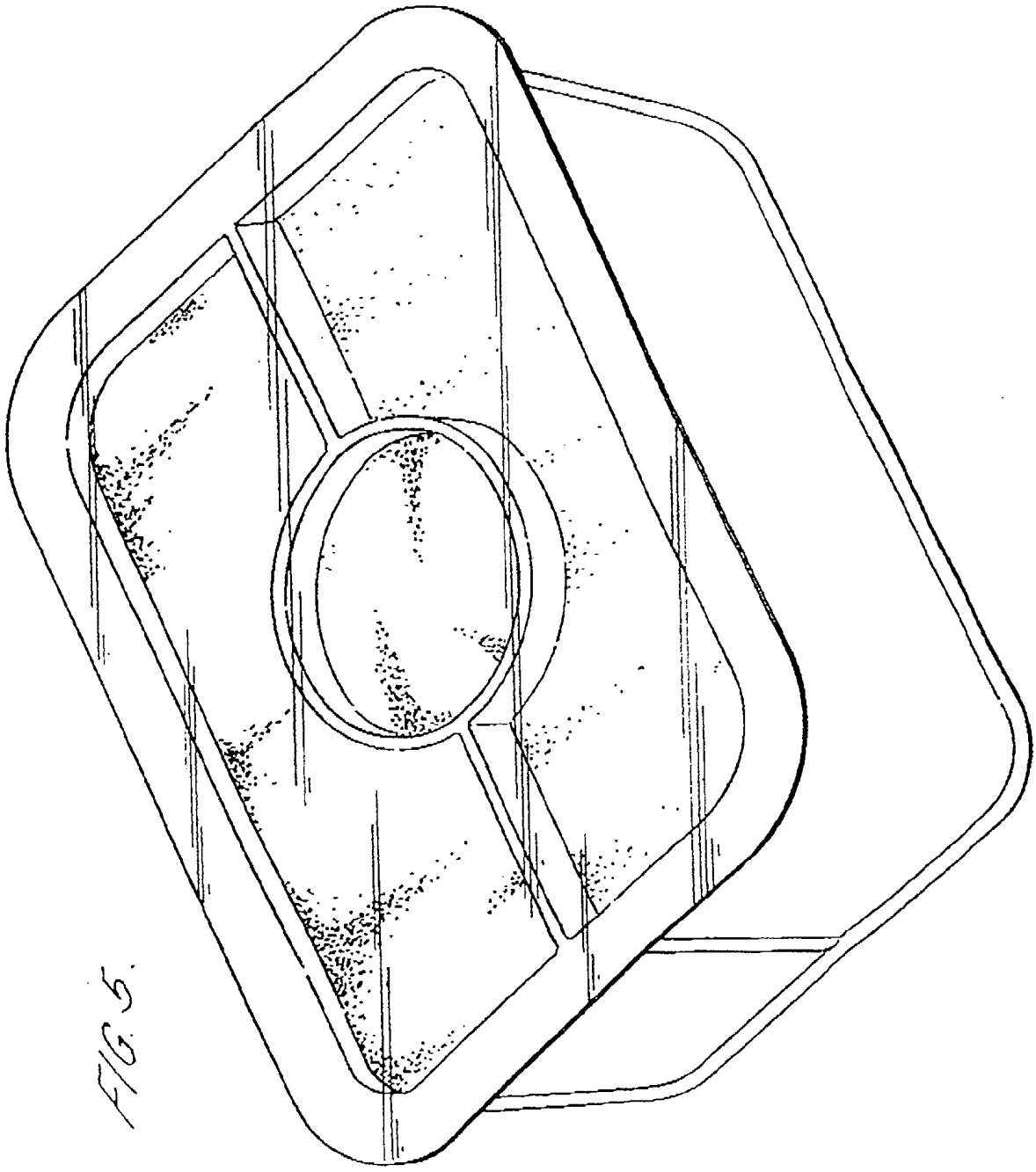


FIG 5.

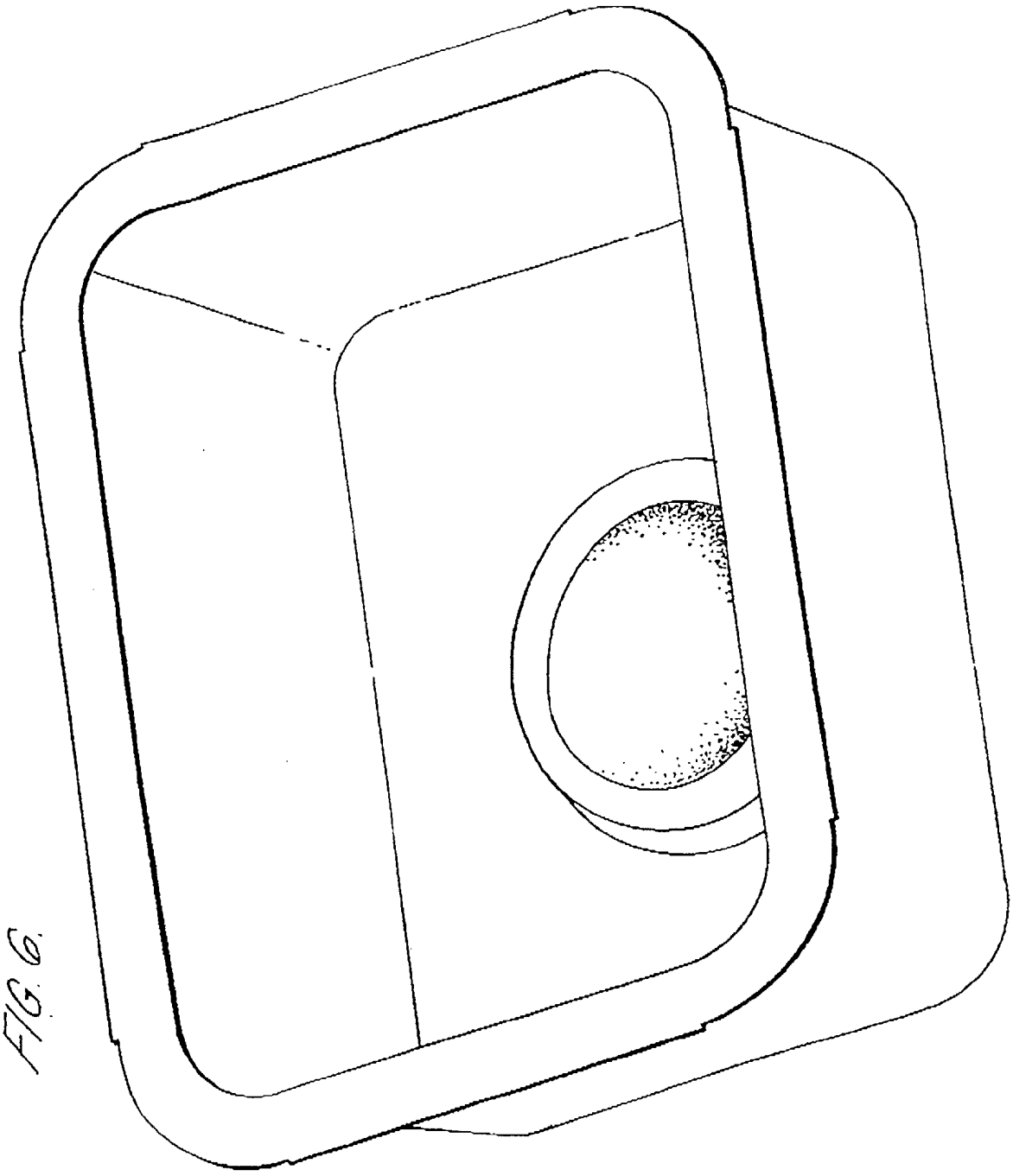


FIG. 6.

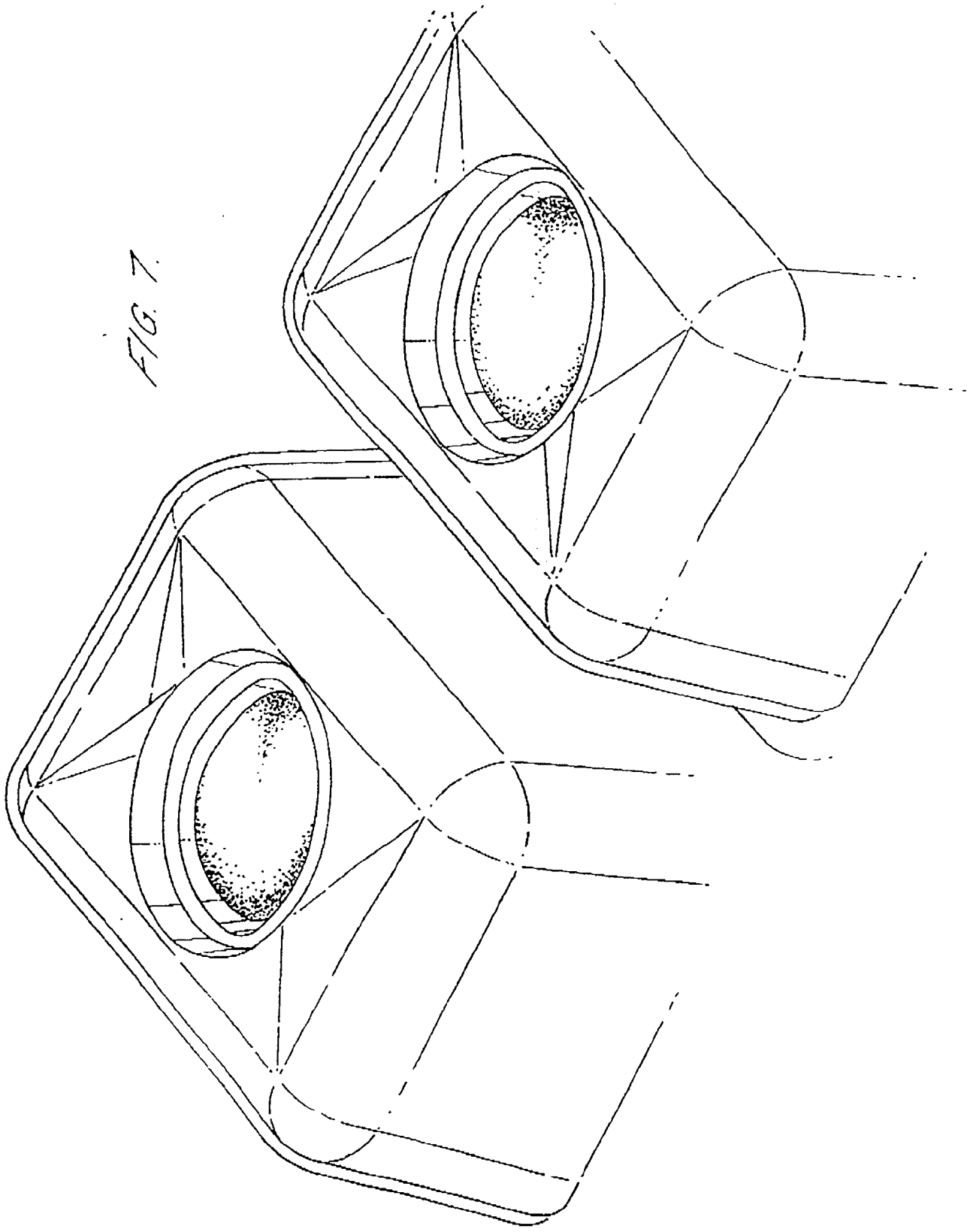


FIG. 7

INJECTION MOULDED CONTAINERS

The present invention relates to rigid, water-soluble containers, in particular to such containers that may be utilised for the delivery into an aqueous environment of a fabric care, surface care or dishwashing composition.

Clothes washing compositions may be delivered to a clothes washing machine by a delivery tray from which the composition is fed into the washing drum, or they may be placed directly into the washing drum. The washing compositions may be in powder, liquid or block form. Liquid compositions have the disadvantage that they may be spilt. The same applies to powder compositions. Powder compositions have the additional disadvantage that they may produce dust which can be inhaled. These problems are overcome or lessened when blocks of washing composition are used. These are normally individually wrapped. On unwrapping a block, for use, it is still possible that some dust may be produced. Additionally it is an inconvenience for the consumer to have to unwrap the block. Furthermore it is almost impossible for the user to avoid some contact between the block and his or her skin, so leading to a requirement for the user to wash their hands after starting the washing machine. In fact, all of the methods described involve a risk of contact between the composition and the skin, and it is desirable in all cases for the user to wash their hands after starting the washing machine. In this context it should be borne in mind that many compositions contain enzymes to assist the cleaning action. Even though the

user may tolerate enzyme residues which may be left in clothes after washing, they may still not tolerate contact between the concentrated washing composition containing the enzymes, and the skin.

Similar considerations apply in relation to other areas including fabric care, surface care and dishwashing. Thus, in relation in particular to dishwashing compositions, there are also problems of spillage, dust generation, skin contact and inconvenience.

It is known to package chemical compositions which may be of a hazardous or irritant nature in water-soluble or water-dispersible materials such as films. The package can simply be added to water in order to dissolve or disperse the contents of the package into the water.

For example, WO 89/12587 discloses a package which comprises an envelope of a water-soluble or water-dispersible material which comprises a flexible wall and a water-soluble or water-dispersible heat seal. The package may contain an organic liquid comprising, for example, a pesticide, fungicide, insecticide or herbicide.

CA-A-1,112,534 discloses a packet made of a water-soluble material in film form enclosing within it a paste-form, automatic dishwasher-compatible detergent composition. The water-soluble material may be, for example, poly(vinyl alcohol), polyethylene oxide or methyl cellulose.

It is also known to form water-soluble containers by thermoforming a water-soluble material. For example, WO 92/17382 discloses a package containing an agrochemical such as a pesticide comprising a first sheet of non-planar water-soluble or water-dispersible material and a second sheet of water-soluble or water-dispersible material superposed on the first sheet and sealed to it by a continuous closed water-soluble or water-dispersible seal along a continuous region of the superposed sheets.

The above methods of packaging have, however, a number of disadvantages.

The first disadvantage is that they do not have a particularly attractive appearance. In fields such as containers used in the domestic environment, an attractive appearance for an article is extremely desirable. Liquids contained in envelopes of water-soluble film can have a limp, unattractive appearance.

The second disadvantage is that it is difficult to form two or more separate compartments in the packaging so that two incompatible components are both enclosed but separated from each other. Although an arrangement has been described to separate incompatible materials in flexible pouches in WO 93/08095, the method proposed is complex and is not currently achievable in large-scale manufacturing. It cannot, therefore, be used for producing large numbers of containers.

The third disadvantage is that there is only limited control of the release profile of the compositions held in the containers. For example, when a composition is held between two planar water-soluble films or in a thermoformed package, the composition is simply released at the time when the films dissolve or disperse in water. While it may be possible to control to a certain extent the timing of the start of release of the contents, there can be no control over the rate of release of the contents since the entire film dissolves or disperses at about the same time. Furthermore it can be difficult to provide an extended time before the contents of the package are released. An additional problem also arises with thermoformed packages. If the thermoforming is not carefully controlled there may be inadvertent thinning of the film material at the points where the material is drawn down into the mould when it is thermoformed. This could release the contents of the package early. Additionally, in all of the above packages, it is not possible to release different compositions at different times or at different rates since, as discussed above, it is not possible to incorporate more than one composition in each water-soluble container.

The fourth disadvantage is that the containers cannot be produced at a particularly fast rate. When the containers are produced by heat-sealing planar films or by thermoforming, the containers have to be immediately filled and sealed. All of these procedures have to be carried out in succession. This means that it is not possible to obtain a quick throughput for mass-market goods such as household products. For example, standard

thermoforming machines can only produce around 400 to 800 containers per minute.

The present invention seeks to provide water-soluble containers which overcome some or all of the above disadvantages.

The present invention has a number of different aspects and embodiments as follows:

A rigid, water-soluble container made entirely or in part of an injection moulded polymer which polymer when dissolved in water is active in detergency, which container encases a fabric care, surface care or dishwashing composition, provided that the polymer is not poly (vinyl alcohol).

By the use of the term "active in detergency" we mean that the polymer can aid the efficiency of the fabric care, surface care or dishwashing composition such as by functioning as, preferably, a water softener or as a dye transfer inhibitor. Specific polymers which are preferred are polyvinylpyrrolidine, polyacrylic acid or an ester thereof, polymaleic acid or an ester thereof, or a copolymer of any thereof. Also included are interpolymers which comprise a blend of any of the above or in addition of another polymer which is also water-soluble. To be active in detergency the polymer must be present in the wash in sufficient quantities to produce the required effect. For example, the use of PVP in an injection moulded container containing a fabric cleaning composition should contain at least 0.2grams of PVP,

ideally at least 0.4grams, the use of poly(acrylic acid) or poly(maleic acid) or an ester of either thereof of a copolymer of any thereof in an injection moulded container containing a fabric cleaning composition should contain at least 2 grams of the polymer to provide adequate water softening. It will be appreciated that not all of the amount of the polymer need be present in the container, a percentage of the polymer may be present inside the container, preferably less than 70%wt, ideally less than 50%wt. For other polymers which are active in detergency it is a simple process to determine the amount of polymer needed.

It will be appreciated that the container may be made in part by any other water-soluble polymer. Therefore, a further feature of the invention is a rigid, water-soluble container made of an injected moulded polymer selected from a "first polymer" , preferably consisting of poly(vinyl alcohol), a cellulose derivative, such as an ether or hydroxypropyl methyl cellulose, poly(glycolide), poly(glycolic acid), poly(lactides), poly (lactic acid) or a copolymer thereof, and at least one additional different polymer which polymer when dissolved in water is active in detergency.

The present invention further provides a method of ware washing, comprising use of a container, receptacle or washing capsule as defined above, the method entailing introducing the container, receptacle or washing capsule into a ware washing machine prior to commencement of the washing process, the container, receptacle or washing capsule being entirely consumed during the washing

process. The ware washing machine may, for example, be a dishwashing or laundry washing machine.

The containers of the present invention overcome some or all of the above disadvantages.

Firstly, because the containers are rigid and self-supporting, they have an attractive, uniform appearance which does not vary between different containers. In addition, a wide variety of different shapes and designs are available. Furthermore, the rigid containers can easily have various elements incorporated which are considered to be pleasing to the eye but which are impossible to incorporate in the flexible containers discussed above.

Secondly, because the containers are rigid, it is easily possible to introduce two or more compartments, or have larger compartments separated by walls, to separate mutually incompatible ingredients. The containers can also hold part of the composition on an external surface, for example in an indentation. Furthermore, the container can be moulded is almost any shape that might be useful. In particular it can be given raised or lowered areas.

Thirdly, it is possible to control the release profile of the contents of the container. Since the container is rigid, it is possible to adapt the width of all of the walls of the container to control both the start of release of the composition as well as the rate of release. For example, one or more walls may be made

thin in order to have an early release of the composition. Alternatively all the walls may be thick in order to ensure that there is a delayed release of the composition. The rate of release of the composition may also be controlled by ensuring that only part of the container has thin walls which are dissolved or dispersed before the remainder of the container. Different walls or parts of walls of the container may be prepared from different water-soluble polymers which have different dissolution characteristics. For example, a first compartment may be fully enclosed by a polymer which dissolves at a higher or lower temperature than the polymer enclosing a second compartment. Thus different components can be released at different times. If the container holds a solid or gelled composition, it is not even necessary for the container to fully enclose the composition. A part may be left exposed, so that it immediately begins to dissolve when added to water.

Fourthly, since the containers are rigid and self-supporting, they can easily be filled on a production line using normal filling equipment. Such filling equipment is quite capable of filling at least 1500 containers per minute.

Fithly the containers as described provide added efficiency to the compositions contained therein by themselves being active in detergency.

Desirably the container, apart from its contents, consists essentially of the injection-moulded polymer or polymers.

It is possible for suitable additives such as plasticizers and lubricants to be included. Plasticizers are generally used in an amount of up to 20 wt%, for example from 15 to 20 wt%, lubricants are generally used in an amount of 0.5 to 5% wt% and the polymer is generally therefore used in an amount of 75 to 84.5 wt%, based on the total amount of the moulding composition.

The container is generally cold water (20°C) soluble, but may be insoluble in cold water at 20°C and only become soluble in warm water or hot water having a temperature of, for example, 30°C, 40°C, 50°C or even 60°C.

For certain applications or uses, containers soluble in aqueous environments at temperatures as low as 5°C are also desirable.

In order to ensure that the polymer is capable of being injection moulded, it is usual to incorporate components such as plasticizers and mould release agents in an amount of up to, for example, 15 wt% of the composition. Suitable plasticizers are, for example, pentaerthyritol such as depentaerythritol, sorbitol, mannitol, glycerine and glycols such as glycerol, ethylene glycol and polyethylene glycol. Solids such as talc, stearic acid, magnesium stearate, silicon dioxide, zinc stearate, and colloidal silica may also be used.

Poly(vinylpyrollidone) may be moulded at temperatures of from 180-220°C, depending upon the formulation selected and the melt flow index required.

Poly(acrylic acid) may be moulded at temperatures of from 180-220°C, for example, depending upon the formulation selected and the melt flow index required.

Poly(maleic acid) may be moulded at temperatures of, from 180-220°C for example, depending upon the formulation selected and the melt flow index required.

The PVOH, when used as a second polymer in the container, may be moulded at temperatures of, for example, from 180-220°C, depending upon the formulation selected and the melt flow index required. A preferred PVOH which is already in a form suitable for injection moulding is sold in the form of granules under the name CP1210T05 by Soltec Developpement SA of Paris, France. The PVOH preferably used to form the container of the present invention may be partially or fully alcoholised or hydrolysed. For example it may be from 40-100%, preferably 70-92 %, more preferably about 88%, alcoholised or hydrolysed polyvinylacetate.

The polymers can be moulded into containers, capsule bodies, caps, receptacles and closures of the appropriate hardness, texture and solubility characteristics.

Preferably the container is a container enclosing a washing composition.

All of the polymer compositions may also include other components such as colouring agents and components which modify their properties.

Injection moulding techniques are well known to the skilled person are described subsequently in the literature (see, for example a good summary is provided in "The Wiley Encyclopedia o Packaging Technology" Wiley Interscience 1986). Special techniques, which use are preferred features of the invention for producing containers having more than one type of polymer are described herein.

Simultaneous injection moulding

1) two or more polymers are molten mixed and injected into a mould

2) two or more polymers are injected into a mould through more than one gate, each gate allowing simultaneous injection of a single polymer or molten mix into the mould

3) simultaneously injection moulding two or more compartments and then joining the compartments together.

Sequential injection moulding

1) multi-component injection moulding

2) sandwich injection moulding

3) sequentially injection moulding two or more compartments and then joining compartments together.

Multi-component injection moulding covers two distinct processes

A) injection moulding a polymer or molten polymer mix into a mould, removing the solid polymer and inserting into a second mould and injection moulding a second polymer or polymer mix into the second mould.

B) injection moulding a polymer or molten polymer mix into a part of a mould, injection moulding a second polymer or molten polymer mix into a further part of the mould.

Steps A) and B) may be repeated more than once and may be mixed. It will be appreciated by the skilled person that the first injection moulded polymer must have sufficient properties to survive the pressure and temperature conditions of the second, or subsequent, injection moulding.

For step B) the first polymer or molten mix may be prevented from entering parts of the mould by any physical means, such as, gates, gravity, positive or negative pressure.

Sandwich injection moulding (or sometimes called skin-care injection moulding) comprises injection moulding a polymer or molten polymer mix into a mould until it is partially filled and then inject a second polymer or molten polymer mix into the same mould through the same gate to form the core. An additional step of sealing the core may be performed.

It will be appreciated that any combination of simultaneous and sequential injection moulding may be used.

A further technique that can be used is to coat part or the entire container, the container being moulded from any water-soluble polymer, with a polymer which is active in detergency, provided that the polymer is not poly (vinyl alcohol). Coating may be achieved by dipping the container into a solution of polymer or in molten polymer or by spray coating of a solution of polymer or molten polymer. It will be appreciated that polymers that are active in detergency but which cannot be injection moulded can be used, such as , preferably, PVNO.

In all aspects and embodiments of the present invention, the container or capsule generally comprises a receptacle part which holds the composition and a closure part, which may simply close the receptacle part or may itself have at least some receptacle function. The receptacle part preferably has side walls which terminate at their upper end in an outward flange in which the closure part is sealingly secured, especially if the closure part is in the form of a film. Ideally the

closure part is joined to the receptacle part directly by means of a hinge part, preferably the receptacle, closure and hinge part are caste in a single mould. The securement may be by means of an adhesive but is preferably achieved by means of a seal, between the flange and the closure part. Preferably the receptacle part is connected to the closure part via a hinge part thus forming a single article which is easily sealed. Heat sealing may be used or other methods such as infra-red, radio frequency, ultrasonic, laser, solvent, vibration or spin welding. An adhesive such as an aqueous solution of PVOH or a cellulose ether may also be used. The seal is desirably also water-soluble.

The closure part may itself be injection moulded or blow moulded. Preferably, however, it is a plastics film secured over the receptacle part. The film may, for example, comprise PVOH or a cellulose ether such as HPMC or another water-soluble polymer.

The container walls have thicknesses such that the containers are rigid. For example, the outside walls and any inside walls which have been injection moulded independently have a thickness of greater than 100μm, for example greater than 150μm or greater than 200μm, 300μm, or 500μm, 750μm or 1mm. Preferably, the closure part is of a thinner material than the receptacle part. If different compartments having different dissolution times are required, different wall thicknesses can be used. A thickness difference of from 100μm to 500μm, preferably

from 250μm to 350m, would give a suitable difference in release times.

Preferably, the closure part dissolves in water (at least to the extent of allowing the washing composition in the receptacle part to be dissolved by the water; and preferably completely) at 40°C in less than 5 minutes, preferably in less than 2 minutes.

The receptacle part and the closure part could be of the same thickness or different thicknesses. The closure part may, for example, be of higher solubility than the receptacle part, in order to dissolve more quickly.

In an alternative feature of the invention we describe a rigid, water-soluble container made entirely or in part of an injection moulded water-soluble polymer, which container encases a fabric care, surface care or dishwashing composition and has bound to the inside or outside of the container or encased within the container a second polymer which polymer when dissolved in water is active in detergency, provided that the second polymer is not poly (vinyl alcohol).

Preferably, the second polymer is polyvinylpyrrolidine, polyacrylic and or an ester, polymaleic acid or an ester thereof, or a copolymer of any thereof.

The second polymer may be in the form of a shaped article, ball, rod, etc, or as a sheet. When attached to

the outside or inside of the container the second polymer can be added to the mould prior to injection moulding.

Preferably, the container is made entirely or in part of poly (vinyl alcohol) in the above preferred feature

Preferably, the washing capsule is generally cuboid in its external shape, with the top wall being formed by the closure part, and with the side walls and base wall being formed by the receptacle part.

Preferably, a washing capsule of the invention is manufactured by forming an array of receptacle parts, each receptacle part being joined to adjacent receptacle parts, and being separable from them by a snap or tear action. The array is preferably one which has columns and rows of the receptacle parts. The receptacle parts may be separated by frangible webs of the water-soluble polymer such as PVOH or a cellulose ether.

Alternatively, the receptacle parts may be manufactured with the aforementioned flanges, such that they are separated from each other by a line of weakness. For example the material may be thinner, and so able to be broken or torn readily. The thinness may be a result of the moulding process or, preferably, of a later scoring step.

In the manufacturing method, the array, formed by injection moulding, is fed to a filling zone, and all the receptacle parts are charged with the washing

composition. A sheet of a water-soluble polymer such as PVOH or a cellulose ether may then be secured over the top of the array, to form the closure parts for all the receptacle parts of the array. The array may then be split up into the individual washing capsules, prior to packaging, or it may be left as an array, for packaging, to be split by the user. Preferably, it is left as an array, for the user to break or tear off the individual washing capsules. Preferably, the array has a line of symmetry extending between capsules, and the two halves of the array are folded together, about that line of symmetry, so that closure parts are in face-to-face contact. This helps to protect the closure parts from any damage, between factory and user. It will be appreciated that the closure parts are more prone to damage than the receptacle parts. Alternatively two identical arrays of washing capsules may be placed together with their closure parts in face-to-face contact, for packaging.

In some embodiments of the invention the container, capsule or receptacle part may define a single compartment. In other embodiments of the invention the container, capsule or receptacle part may define two or more compartments, which contain different products useful in a washing process. In such a situation a dividing wall or walls of the compartments preferably terminate at the top of the container, capsule or receptacle part i.e. in the same plane as the top edges of the side walls, so that when the receptacle part is closed by the closure part the contents of the compartments cannot mix. The container, capsule or

receptacle part may be provided with an upstand, preferably spaced from the side walls thereof, and preferably of generally cylindrical shape. If wished, the remaining volume of the container, capsule or receptacle part can be divided into two or more parts by means of walls extending between the upstand and the side walls.

The container, capsule, receptacle part or closure may be formed with an opening, for example a depression, formed in the side wall or the base wall, and preferably being open in the outward direction. That is to say, it preferably does not form part of the main volume defined by the container, capsule, receptacle part or closure. Preferably the opening is adapted to receive, in a press-fit manner, a solid block (for example a tablet) of a composition, for example a material useful in a washing process.

Preferably, the closure part is of a transparent or translucent material, so that the contents of the washing capsule can be seen.

Preferably, the container, capsule or receptacle part is of a transparent or translucent material, so that the contents of the washing capsule can be seen.

The washing composition within the container, capsule or receptacle part, or within a compartment thereof, need not be uniform. For example during manufacture it could be fed first with a settable agent, for example a gel, useful in a washing process, and then

with a different material. The first material could dissolve slowly in the washing process so as to deliver its charge over a long period within the washing process. This might be useful, for example, to provide immediate, delayed or sustained delivery of a softening agent in a clothes washing container, capsule or a receptacle part.

The container, or capsule may, for example, be in at least two parts (a body part and a cap part) which fit tightly, and preferably sealingly and inseparably, together to form a compartment in which is stored the ingredient to be achieved. In one example, the container or capsule may have three parts - a body such as a receptacle, a first cap, and then a second cap to fit over the closed end of either the body or the first cap, so as to result in a capsule with two separate compartments. Where there are three such parts (or more; four parts – a body and three caps - make three compartments, and so on), then naturally the ingredients in each compartment may be the same or they may be different.

In all embodiments of the present invention one compartment may contain, for example, a liquid or solid component (such as a powder, granules or a compressed or gelled tablet) and another may contain a different liquid or solid component (such as a powder, granules or a compressed or gelled tablet). Alternatively, more than one component may be present in one or more compartments. For example a compartment may contain a solid component, for example in the form of a ball or pill (such as a

powder, granules or a compressed or gelled tablet), and a liquid component.

Desirably the composition has a mass of at least 10 g or 15 g, for example, from 10 g or 15 g to 100 g, especially from 10 g to 15 g to 40 g. For example, a dishwashing composition may weigh from 10 g or 15 g to 20 g, a water-softening composition may weigh from 25 g to 35 g, and a laundry composition may weigh from 10 g to 40 g, 20 g to 40 g or 30 g to 40 g.

In general the maximum dimension of the container is 5 cm. For example, a cuboid container may have a length of 1 to 5 cm, especially 3.5 to 4.5 cm, a width of 1.5 to 3.5 cm, especially 2 to 3 cm, and a height of 1 to 2 cm, especially 1.25 to 1.75 cm.

The composition contained by the container may be, for example, any which is suitable for the designated application, for example a clothes washing or dishwashing application. It may be a powder or a liquid but if a liquid, may be a low water formulation, preferably having a maximum water content of 5 wt%, in order to maintain the integrity of the walls of the capsule or a higher water formulation containing, for example, at least 8 wt% water. It will be appreciated that higher water contents may be present where the water is chemically or physically bound. The composition may be formulated having regard to the fact that the user will not come into contact with the composition, whether by inhalation or by skin contact. For example, the composition may include an enzyme, without concern about physical contact

between the composition containing the enzyme, and the user.

If the container contains an aqueous liquid having a relatively high free water content, it may be necessary to take steps to ensure the liquid does not attack the water-soluble polymer if it is soluble in cold water (20°C), or water at a temperature of up to, say, 35°C. Steps may be taken to treat the inside surfaces of the container, for example by coating it with agents such as PVdC (poly(vinylidene chloride))or PTFE (polytetrafluoroethylene), or to adapt the composition to ensure that it does not dissolve the polymer. For example, it has been found that ensuring the composition has a high ionic strength or contains an agent which minimises water loss through the walls of the container will prevent the composition from dissolving the polymer from the inside. This is described in more detail in EP-A-518,689 and WO 97/27743.

The composition held within the container depends, of course, on the intended use of the composition. It may, for example, contain surface active agents such as an anionic, non-ionic, cationic, amphoteric or zwitterionic surface active agent or mixture thereof.

Examples of anionic surfactants are straight-chained or branched alkyl sulfates and alkyl polyalkoxylated sulfates, also known as alkyl ether sulfates. Such surfactants may be produced by the sulfation of higher C_8-C_{20} fatty alcohols.

Examples of primary alkyl sulfate surfactants are those of formula:

$ROSO_3^-M^+$

wherein R is a linear C_8-C_{20} hydrocarbyl group and M is a water-solubilising cation. Preferably R is C_{10}-C_{16} alkyl, for example C_{12}-C_{14}, and M is alkali metal such as lithium, sodium or potassium.

Examples of secondary alkyl sulfate surfactants are those which have the sulfate moiety on a "backbone" of the molecule, for example those of formula:

$CH_2(CH_2)_n(CHOSO_3^-M^+)(CH_2)_mCH_3$

wherein m and n are independently 2 or more, the sum of m+n typically being 6 to 20, for example 9 to 15, and M is a water-solubilising cation such as lithium, sodium or potassium.

Especially preferred secondary alkyl sulfates are the (2,3) alkyl sulfate surfactants of formulae:

$CH_2(CH_2)_x(CHOSO_3^-M^+)CH_3$ and

$CH_3(CH_2)_x(CHOSO_3^-M^+)CH_2CH_3$

for the 2-sulfate and 3-sulfate, respectively. In these formulae x is at least 4, for example 6 to 20, preferably 10 to 16. M is cation, such as an alkali metal, for example lithium, sodium or potassium.

Examples of alkoxylated alkyl sulfates are ethoxylated alkyl sulfates of the formula:

$RO(C_2H_4O)_nSO_3^-M^+$

wherein R is a C_8-C_{20} alkyl group, preferably C_{10}-C_{18} such as a C_{12}-C_{16}, n is at least 1, for example from 1 to 20, preferably 1 to 15, especially 1 to 6, and M is a salt-forming cation such as lithium, sodium, potassium, ammonium, alkylammonium or alkanolammonium. These compounds can provide especially desirable fabric cleaning performance benefits when used in combination with alkyl sulfates.

The alkyl sulfates and alkyl ether sulfates will generally be used in the form of mixtures comprising varying alkyl chain lengths and, if present, varying degrees of alkoxylation.

Other anionic surfactants which may be employed are salts of fatty acids, for example C_8-C_{18} fatty acids, especially the sodium potassium ir alkanolammonium salts, and alkyl, for example C_8-C_{18}, benzene sulfonates.

Examples of nonionic surfactants are fatty acid alkoxylates, such as fatty acid ethoxylates, especially those of formula:

$$R(C_2H_4O)_nOH$$

wherein R is a straight or branched C_8-C_{16} alkyl group, preferably a C_9-C_{15}, for example C_{10}-C_{14}, or C_{12}-C_{14} alkyl group and n is at least 1, for example from 1 to 16, preferably 2 to 12, more preferably 3 to 10.

The alkoxylated fatty alcohol nonionic surfactant will frequently have a hydrophilic-lipophilic balance (HLB) which ranges from 3 to 17, more preferably from 6 to 15, most preferably from 10 to 15.

Examples of fatty alcohol ethoxylates are those made from alcohols of 12 to 15 carbon atoms and which contain about 7 moles of ethylene oxide. Such materials are commercially marketed under the trademarks Neodol 25-7 and Neodol 23-6.5 by Shell Chemical Company. Other useful Neodols include Neodol 1-5, an ethoxylated fatty alcohol averaging 11 carbon atoms in its alkyl chain with about 5 moles of ethylene oxide; Neodol 23-9, an ethoxylated primary C_{12}-C_{13} alcohol having about 9 moles of ethylene oxide; and Neodol 91-10, an ethoxylated C_9-C_{11} primary alcohol having about 10 moles of ethylene oxide.

Alcohol ethoxylates of this type have also been marketed by Shell Chemical Company under the Dobanol trademark. Dobanol 91-5 is an ethoxylated C_9-C_{11} fatty alcohol with an average of 5 moles ethylene oxide and Dobanol 25-7 is an ethoxylated C_{12}-C_{15} fatty alcohol with an average of 7 moles of ethylene oxide per mole of fatty alcohol.

Other examples of suitable ethoxylated alcohol nonionic surfactants include Tergitol 15-S-7 and Tergitol 15-S-9, both of which are linear secondary alcohol ethoxylates available from Union Carbide Corporation. Tergitol 15-S-7 is a mixed ethoxylated product of a C_{11}-C_{15} linear secondary alkanol with 7 moles of ethylene

oxide and Tergitol 15-S-9 is the same but with 9 moles of ethylene oxide.

Other suitable alcohol ethoxylated nonionic surfactants are Neodol 45-11, which is a similar ethylene oxide condensation products of a fatty alcohol having 14-15 carbon atoms and the number of ethylene oxide groups per mole being about 11. Such products are also available from Shell Chemical Company.

Further nonionic surfactants are, for example, C_{10}-C_{18} alkyl polyglycosides, such s C_{12}-C_{16} alkyl polyglycosides, especially the polyglucosides. These are especially useful when high foaming compositions are desired. Further surfactants are polyhydroxy fatty acid amides, such as C_{10}-C_{18} N-(3-methoxypropyl) glycamides and ethylene oxide-propylene oxide block polymers of the Pluronic type.

Examples of cationic surfactants are those of the quaternary ammonium type.

Examples of amphoteric surfactants are C_{10}-C_{18} amine oxides and the C_{12}-C_{18} betaines and sulfobetaines.

The total content of surfactants in the laundry or detergent composition is desirably 60 to 95 wt%, especially 75 to 90 wt%. Desirably an anionic surfactant is present in an amount of 50 to 75 wt%, the nonionic surfactant is present in an amount of 5 to 20 wt%, the cationic surfactant is present in an amount of from 0 to 10 wt% and/or the amphoteric surfactant is present in the

amount of from 0 to 10 wt%. These amounts are based on the total solids content of the composition, i.e. excluding the water when present.

Dishwasher compositions usually comprise a detergency builder. Suitable builders are alkali metal or ammonium phosphates, polyphosphates, phosphonates, polyphosphonates, carbonates, bicarbonates, borates, polyhydroxysulfonates, polyacetates, carboxylates such as citrates and other polycarboxylates. The builder is desirably present in an amount of up to 90 wt%, preferably 15 to 90 wt%, more preferably 15 to 75 wt%, relative to the total weight of the composition. Further details of suitable components are given in, for example, EP-A-694,059, EP-A-518,720 and WO 99/06522.

The compositions, particularly when used as laundry washing or dishwashing compositions, may also comprise enzymes, such as protease, lipase, amylase and cellulase enzymes. Such enzymes are commercially available and sold, for example, under the registered trade marks Esperase, Alcalase, Savinase, Termamyl, Lipolase and Celluzyme by Nova Nordisk A/S. Desirably the enzymes are present in the composition in an amount of from 0.5 to 3 wt%, especially 1 to 2 wt%.

The compositions may, if desired, comprise a thickening agent or gelling agent. Suitable thickeners are polyacrylate polymers such as those sold under the trade mark CARBOPOL, or the trade mark ACUSOL by Rohm and Hass Company. Other suitable thickeners are xanthan

gums. The thickener, if present, is generally present in an amount of from 0.2 to 4 wt%, especially 0.2 to 2 wt%.

The compositions can also optionally comprise one or more additional ingredients. These include conventional detergent composition components such as further surfactants, bleaches, bleach enhancing agents, builders, suds boosters or suds suppressors, anti-tarnish and anti-corrosion agents, organic solvents, co-solvents, phase stabilisers, emulsifying agents, preservatives, soil suspending agents, soil release agents, germicides, phosphates such as sodium tripolyphosphate or potassium tripolyphosphate, pH adjusting agents or buffers, non-builder alkalinity sources, chelating agents, clays such as smectite clays, enzyme stabilizers, anti-limescale agents, colourants, dyes, hydrotropes, dye transfer inhibiting agents, brighteners, and perfumes. If used, such optional ingredients will generally constitute no more than 10 wt%, for example from 1 to 6 wt%, the total weight of the compositions.

The builders counteract the effects of calcium, or other ion, water hardness encountered during laundering or bleaching use of the compositions herein. Examples of such materials are citrate, succinate, malonate, carboxymethyl succinate, carboxylate, polycarboxylate and polyacetyl carboxylate salts, for example with alkali metal or alkaline earth metal cations, or the corresponding free acids. Specific examples are sodium, potassium and lithium salts of oxydisuccinic acid, mellitic acid, benzene polycarboxylic acids, C_{10}-C_{22} fatty acids and citric acid. Other examples are organic

phosphonate type sequestering agents such as those sold by Monsanto under the trade mark Dequest and alkylhydroxy phosphonates. Citrate salts and C_{12}-C_{18} fatty acid soaps are preferred.

Other suitable builders are polymers and copolymers known to have builder properties. For example, such materials include appropriate polyacrylic acid, polymaleic acid, and polyacrylic/polymaleic and copolymers and their salts, such as those sold by BASF under the trade mark Sokalan.

The builders generally constitute from 0 to 3 wt%, more preferably from 0.1 to 1 wt%, by weight of the compositions.

Compositions which comprise an enzyme may optionally contain materials which maintain the stability of the enzyme. Such enzyme stabilizers include, for example, polyols such as propylene glycol, boric acid and borax. Combinations of these enzyme stabilizers may also be employed. If utilized, the enzyme stabilizers generally constitute from 0.1 to 1 wt% of the compositions.

The compositions may optionally comprise materials which serve as phase stabilizers and/or co-solvents. Example are C_1-C_3 alcohols or diols such as methanol, ethanol, propanol and 1,2-propanediol. C_1-C_3 alkanolamines such as mono-, di- and triethanolamines and monoisopropanolamine can also be used, by themselves or in combination with the alcohols.

If the composition is in liquid form, it may be anhydrous, or, for example, contain up to 5 wt% water. Aqueous compositions generally contain greater than 8 wt% water based on the weight of the aqueous composition. Desirably the aqueous compositions contain more than 10 wt%, 15 wt%, 20 wt%, 25 wt% or 30 wt% water, but desirably less than 80 wt% water, more desirably less than 70 wt%, 60 wt%, 50 wt% or 40 wt% water. They may, for example, contain from 30 to 65 wt% water.

The compositions may optionally comprise components which adjust or maintain the pH of the compositions at optimum levels. Examples of pH adjusting agents are NaOH and citric acid. The pH may be from, for example, 1 to 13, such as 8 to 11 depending on the nature of the composition. For example, a dishwashing composition desirably has a pH of 8 to 11, a laundry composition desirably has a pH of 7 to 9, and a water-softening composition desirably has a pH of 7 to 9.

The composition, such as a washing composition within the container, capsule or receptacle part, or within a compartment thereof if there is more than one compartment, need not be uniform. For example during manufacture it could be fed first with a settable agent, for example a gel, useful in a washing process, and then with a different material. The first material could dissolve slowly in the washing process so as to deliver its charge over a long period within the washing process. This might be useful, for example, to provide delayed or sustained delivery of a softening agent in a clothes washing capsule.

The composition, such as a washing composition may, especially for dishwashing or laundry, include a tablet. Preferably a tablet contains a material useful in a washing process and is formulated to provide slow release of that material during a washing process and/or delayed release thereof. Delayed release may be achieved by providing the tablet with a coating which is slow to dissolve during the washing process. Alternatively the tablet may provide a quick release of components required early in the wash, for example water-softening components and/or enzymes. The tablet may, for example, comprise a disrupting agent, such as one which effervesces when in contact with water such as a combination of citric acid and an alkali metal carbonate or bicarbonate.

A tablet may be provided in the main volume of the receptacle part or may be provided in an outwardly facing opening or depression, as previously described.

When a washing capsule of the invention has a tablet retained in an outwardly facing opening or depression the tablet is preferably one which will not transfer any washing composition to the hands of a user. For example, it may be coated with a soluble polymeric material. As mentioned above, this may also be desirable for delayed release of its charge. If it is desired that the tablet dissolves quickly it may, for example, comprise a disrupting agent such as an effervescing agent.

Fig. 1 shows an array of eight receptacle parts 2, arranged as two columns and four rows. Each receptacle

part has a flat base wall without indentations or recesses and four uprights side walls 4, and has no top wall. Thus, each receptacle part is upwardly open. Around its opening, at the top of the side walls 4, is an outwardly-directed flange 6, which extends around the entire opening. The receptacle parts are joined to adjacent receptacle parts by webs 8 between the flanges 6. The flanges 6 of all of the receptacle parts lie in one plane. The base walls of all of the receptacle parts also lie in one place, parallel to the plane in which the flanges lie.

The array shown in the drawing is made by injection moulding. The thermoplastic polymer employed in this embodiment is polyvinyl alcohol, and is translucent. The wall thickness is about 0.7 mm. The resulting moulded array is self-supporting.

After injection moulding score lines may be cut into the webs 8 between the flanges, to aid the breaking apart of the washing capsules, for use.

The moulded array is fed to a filling zone where the receptacle parts are simultaneously filled via eight nozzles, with a dishwashing composition. The dishwashing composition could be a powder, gel or paste or could be a liquid formulation. If it is a liquid it may be a liquid formulation of relatively low water content, for example, 2 to 5 wt%, given the properties of the polymer. Alternatively the water content may be higher, for example up to 60 wt% or even 80 wt%, so long as the polymer is not attacked by the composition. Such steps

are described above. A translucent cover film is then laid over the array and heat sealed against the flanges 6, so that each receptacle part has, over it, a closure part. The drawing illustrates the invention but in practice an array of receptacle parts is likely to be considerably larger. Nevertheless, the manufacturing method would be as described.

In use, a user will simply break off a washing capsule from the array, and put it in the dishwashing machine. During the washing process the entire washing capsule will dissolve. The first part to dissolve will generally be the closure part. This may happen very quickly once the washing process starts and the washing composition will immediately be delivered. The receptacle part will generally dissolve more slowly but it will have dissolved entirely by the end of the washing process.

Figs. 2 and 3 show an alternative embodiment of the receptacle parts. The receptacle parts shown in Figs. 2 and 3 are of similar shape and size to those shown in Fig. 1, but have, within the main chamber defined by the base wall and side walls of each receptacle part, a generally cylindrical upstand 10, in a central position. Each upstand is open at its upper end, and its upper end is in the same plane as the flange 6.

As shown in Fig. 3, each receptacle part also has a depression 12 at a central position in its base wall. The depression is relatively shallow, and it is aligned with the upstand 10 carried by the base wall on its other

side. Each depression contains within it a tablet 14. Each tablet contains a washing composition or a material which forms part of a washing composition, but is formulated for quick release, slow release and/or delayed release. For slow release it may be a tablet which dissolves over an extended period. For delayed release it may be a table coated with a polymeric coating which is slow to dissolve, so that it releases its charge in the middle or towards the end of a washing cycle.

Another difference between the embodiment of Fig. 2 and that of Fig. 1 is that in the Fig. 2 embodiment there is a plurality of breakable webs 16 of polymeric material extending between the flanges of adjacent receptacle parts.

The array shown in Figs. 2 and 3 is again made by injection moulding, using HPMC polymer having a wall thickness of about 0.8 mm, although PVOH, for example, may also be used. Tablets 14 are press-fitted into the depressions 12 in the undersides of the base walls. The array is then inverted for filling. The upstands 10 are filled with one material, and the remaining volumes, between the upstands and the side walls of the respective receptacle parts, are filled with another material. A cover film is then laid over the array and heat sealed against the flanges 6 and against the ends of the upstands 10, so that each receptacle part has, over it, a closure part.

The embodiment shown in Figs. 4 and 5 is similar to that of Figs. 2 and 3 in having an upstand. However the

remaining volume of the receptacle part is divided into two by means of walls 18, 20, extending from the upstand in opposed directions, and with each connecting with a respective side wall of the receptacle part. It will be apparent that the receptacle part comprises three main chambers whose contents are released into the washing water once the closure part dissolves. One chamber 22 is defined within the upstand and the other chambers 24, 26 are of identical size to each other and are defined between the upstand and the side walls. The underside of the receptacle part may, like the embodiment of Figs. 2 and 3, comprise a central depression into which is pressed a tablet. The receptacle parts are formed, in an array, by injection moulding.

Fig. 5 shows a washing capsule which uses the receptacle part shown in Fig. 4. The receptacle part has been filled with three different materials useful in a dishwashing cycle and a cover film is shown in place.

The embodiment of Figs. 6 and 7 is simpler than those of Figs. 2 to 5. The receptacle part shown does not have a central upstand. There is one main volume. However the underside of the base wall is moulded with a depression and into this depression is press-fitted a tablet. In the embodiment of Figs. 6 and 7 the main chamber of the receptacle part can be filled with two or more gels which stay separate, for example, side by side, or one within the other, or in the form of separate stripes. The receptacle parts of Figs. 6 and 7 may be formed, in an array, by vacuum forming.

In the embodiments of Figs. 4 to 7 the materials selected for the receptacle parts and closure parts, and their thicknesses, are as described for the Fig. 1 embodiment.

CLAIMS

1. A rigid, water-soluble container made entirely or in part of an injection moulded polymer which polymer when dissolved in water is active in detergency, which container encases a fabric care, surface care or dishwashing composition, provided that the polymer is not poly (vinyl alcohol).

2. A rigid, water-soluble container made entirely or in part of an injection moulded polymer which polymer when dissolved in water is active as a water softener or as a dye transfer inhibitor.

3. A rigid, water-soluble container, as claimed in claim 2, made entirely or in part of an injection moulded polymer which polymer is poly(vinylpyrrolidone), poly(acrylic acid) or an ester thereof or poly(maleic acid) or an ester thereof,or a copolymer of an thereof.

4. A rigid, water-soluble container made of an injected moulded polymer selected from a first polymer consisting of poly(vinyl alcohol), a cellulose derivative, preeably and ether or hydroxypropyl methyl cellulose, poly(glycolide), poly(glycolic acid), poly(lactide), poly(lactic acid) or a copolymer of any thereof and at least one additional different polymer which polymer when dissolved in water is active in detergency.

5. A container according to claim 4 wherein the first and additional polymer(s) are simultaneously or sequentially injection moulded.

6. A container according to any one of the preceding claims which has two or more compartments.

7. A container according to any one of the preceding claims which comprises a polymer selected from at least one of the following;

poly(vinylpyrrolidone), poly(acrylic acid) or an ester thereof or poly(maleic acid) or an ester thereof,or a copolymer of an thereof.

8. A container according to any one of the preceding claims wherein the container is made from a receptacle part and is sealed by a water-soluble closure part, preferably in the form of a film or injection-moulded, rigid closure.

9. A container according to claim 8 wherein the closure part comprises a poly(vinyl alcohol) film or closure.

10. A container according to claim 8 or claim 9 wherein the receptacle part has side walls which terminate at their upper end in an outward flange, to which the closure part is sealingly secured.

11. A container according to claim 10 wherein the closure part is a plastics film.

12. A container according to any one of the preceding claims wherein the composition comprises a powder, gel, paste or low water liquid formulation.

13. A container according to any one of claims 10 to 12 wherein the container comprises a tablet formulated for delayed and/or sustained release of a material.

14. A container according to claim 8 wherein the receptacle part defines two or more compartments and at least one compartment is made entirely or in part of a polymer which when dissolved in water is active in detergency provided that the polymer is not poly(vinyl alcohol).

15. A capsule according to claim 14 wherein the receptacle part comprises an upstanding wall which separates compartments thereof.

16. A container according to claim 14 wherein the polymer active in detergency is selected from selected from at least one of the following;

poly(vinylpyrrolidone), poly(acrylic acid) or an ester thereof or poly(maleic acid) or an ester thereof,or a copolymer of an thereof.

17. A container according to claim 14 wherein a first compartment is made entirely or in part of a polymer which when dissolved in water is active in detergency.

18. A container according to claim 14 wherein at least one compartment is made at least partly of a second polymer which is poly(vinyl alcohol), a cellulose derivative, preferably an ether or hydroxypropyl methyl cellulose, poly(glycolide), poly(glycolic acid), poly(lactide), poly(lactic acid) or a copolymer of any thereof.

19. A container according to claim 18 wherein the second polymer is poly(vinyl alcohol).

20. A container according to claim 18 or 19 wherein the first compartment dissolves in water at a different rate than the second compartment.

21. A container according to any one of claims 8 to 30 wherein the receptacle part comprises an outwardly facing opening into which a tablet, preferably comprising a material useful in a washing process, is press-fitted.

22. A container according to any one of claims 8 to 30 wherein the closure part is a transparent or translucent material.

23. A container according to any one of claims 1 to 22 made entirely or in part of polyvinylpyrolidine.

24. An array of washing containers as defined in any one of claims 1 to 23 which are joined together but are readily separable from each other for use.

25. An array according to claim 24 wherein the array has a line of symmetry extending between capsules, and the two halves of the array are folded together about the line of symmetry, with the closure parts in face-to-face contact.

26. A method of manufacturing an array of washing capsules as defined in claim 24 or 25, which method comprises: forming an array of receptacle parts, each receptacle part being connected to adjacent receptacle parts but being separable from them by a snap or tear action; charging the receptacle parts with washing composition; and sealingly securing a sheet of a water-soluble polymer over the top of the array, to form the closure parts for all the receptacle parts of the array.

27. A process for the manufacture of a container as claimed in claim 1, which comprises melting the polymer(s), injecting the molten polymer(s) into a mould, removing the rigid water soluble container from the mould and adding the fabric care, surface care, or dishwashing composition into the container.

28. A process for the manufacture of a container as claimed in claim 2 which comprises melting the polymer, injecting the molten polymers into a mould, removing the rigid water soluble container from the mould and adding the fabric care, surface care, of dishwashing composition into the container.

29. A process according to claim 28 wherein the first polymer and the additional polymer(s) are simultaneously or sequentially injected into the mould.

30. A process according to claim 29 wherein the first polymer and the additional polymer(s) are sequentially injected into the mould, in any order, by one of the following techniques, multi-component injection moulding or sandwich injection moulding.

31. A process according to claim 30 wherein the first polymer and the additional polymer(s) are sequentially injected into the mould, in any order, injection moulding a polymer or molten polymer mix into a mould, removing the solid polymer and inserting into a second mould and injection moulding a second polymer or polymer mix into the second mould.

32. A process according to claim 30 wherein the first polymer and the additional polymer(s) are sequentially injected into the mould, in any order, injection moulding a polymer or molten polymer mix into a part of a mould, injection moulding a second polymer or molten polymer mix into a further part of the mould.

33. A process according to claim 30 wherein the first polymer and the additional polymer(s) are simultaneously injection moulded into the mould as a molten mix.

34. A process according to any one of claims 27 to 33 comprising the additional step of sealing the container.

35. A rigid, water-soluble container made entirely or in part of an injection moulded water-soluble polymer, which container encases a fabric care, surface care or dishwashing composition and has bound to the inside or outside of the container or encased within the container a second polymer which polymer when dissolved in water is active in detergency, provided that the second polymer is not poly (vinyl alcohol).

36. A rigid, water-soluble container as claimed in claim 35 wherein the second polymer is polyvinylpyrolidine, polyacrylic acid or an ester thereof, polymaleic acid or an ester thereof, or a copolymer of any thereof.

37. A rigid, water-soluble container as claimed in claim 35 or 36 wherein the second polymer is in the form of a shaped article.

38. A rigid, water-soluble container as claimed in any claim from 35 to 37 wherein the container is made entirely or in part of poly (vinyl alcohol).

INVESTOR IN PEOPLE

Application No:	GB 0112048.4	**Examiner:**	Dr Paul R Minton
Claims searched:	1-35	**Date of search:**	1 November 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): C3V (VEH); C5D (DDX).

Int Cl (Ed.7): B65D 65/46; C11D 17/04, 17/08.

Other: ONLINE: WPI, EPODOC, JAPIO.

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X, E	GB 2358382 A	(RECKITT BENCKISER *et al*). See whole document.	4 at least
A	GB 1307387 A	(RAION). See whole document.	
A	GB 1292799 A	(LION). See whole document.	
X,Y	WO 99/64087 A1	(ISOLYSER). See particularly lines 28-29, page 4, lines 9-10, page 6, and lines 16-18 & 22-23, page 10,	X:2,3 at least Y:23 at least
Y	CA 2314363 A	(HENKEL). See particularly lines 15-27, page 47 and line 25, page 50 to line 7, page 51.	23 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.